REPORT ON FEDERAL INFORMATION DISSEMINATION

RESPONSES TO
DECISION ANALYSIS FRAMEWORK
FOR GPO STRATEGIC ALTERNATIVES

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January 4, 1988

For
Office of Technology Assessment
United States Congress

These documents were prepared by outside contractors as inputs to an on-going OTA assessment. They do not necessarily reflect the analytical findings of OTA.

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Washington, D.C. 20510

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Although this report is specifically to address technology issues at the GPO, comments, opinions and data have been provided in other related areas.

Executive Summary

There are two major driving forces that will continue to change conventional printing and publishing:

1. Proliferation in the demand for information.
2. Proliferation of technology and its application.

These forces have a synergistic effect on one another and on those services that support both information providers and information consumers.

The Government Printing Office is such a support service and it stands at a crossroads.

Its print-on-paper monopoly within the Federal infrastructure is being challenged as its workload shifts from an overwhelming preponderance of Legislative work to an overwhelming preponderance of Executive work.

Its technology is still based on conventional printing, but pre-press and other electronic approaches are increasingly providing electronic byproducts that can be disseminated without paper.

Its largest customer base, the Executive agencies, are implementing various approaches to information capture, page processing and camera-ready output, with electronic byproducts of their own.

Its products are used by a widely diverse group of audiences, some of whom would benefit from and have the capability to accept information in electronic form and some who would not.

Its mandate to maintain a centralized service for priority Legislative work often conflicts with decentralization tendencies on the part of Executive "customers".

To address these issues, OTA has developed a decision analysis framework to collect data and opinions as a prelude to the establishment of meaningful alternatives that will best serve the American people, the Federal infrastructure and the GPO. The specific task of this report was an evaluation of GPO technnology, products and relationships with its "customers". To accomplish our task we have had to develop alternative sources of data since GPO nor any other Government entity maintains the kind of information we consider necessary to understand and analyze many relevant aspects.

Thus a great deal of estimation and subjective analysis has been rendered. The result is a "snapshot" of Federal information as viewed from the standpoint of the GPO and sample Executive agencies that suggests:

1. The vast majority of work done by the GPO is Executive in nature for both printing and procurement. GPO is a defacto Executive branch agency.
2. If it were, in fact, under Executive control priority Legislative work could be handled as routinely as Executive branch priority work is presently handled and Congress would still have oversight.
3. Attempts to separate workloads (Legislative vs. Executive) or functions (printing vs. procurement) would result in duplication of effort and increased cost for products and services.
4. The dissemination of information via electronic distribution in a variety of formats is a viable approach for those audiences that have the technology for access, but there will continue to be audiences without the technology for access.
5. The production of material utilizing electronic printing and publishing technology is also a viable alternative, especially if NTIS materials are merged with appropriate GPO materials, so as to provide a larger base of similiar work types in order to eliminate duplication of effort.
6. Electronic approaches will be limited by the volume of materials that are a. potentially eligible (that is, of a nature that allows electronic approaches), and b. actually releasable outside of government (e.g. military materials may not be and they represent over 30% of GPO volume).
7. Estimates indicate that approximately 61% of GPO printed and procured volume (and by extrapolation it might be applicable for all Federal Government volume) is eligible for electronic approaches but only about half of this volume may possibly be distributed electronically.
8. That volume which lends itself to electronic and demand printing is low, but when merged with NTIS volume, which is overwhelmingly appropriate for these methods, would provide a base of work that could support more advanced technology for reproduction and binding.

9. Ink or toner on paper will continue to be a required format for Government information and for many information consumers and must be factored into all decisions.

Some of these conclusions are based on estimates and opinions. They are open to challenge. GPO has not been able to provide much of the data requested or to venture estimates in some of these areas since they do not maintain their management information so as to do so. However, we feel that it is vital that some quantification is provided so as to establish a base for discussion, dialogue and decisionmaking.

A. GPO role in ensuring public access to Federal information.

Should GPO extend this role to include electronic as well as paper formats, low demand and more specialized reports, and newer forms of Federal information (e.g., software, data bases)?

The underlying data for both electronic and paper formats is essentially the same. Thus any service organization that supports one format can, and should, support all other required formats. The GPO is already providing alternative formats to print communication, such as microfilm and data base magnetic tapes because:

1. The data exists in such a state that it can be provided in such alternative form as a byproduct of the pre-press process.
2. The nature of the data would benefit from electronic searches, indexing, access, etc.
3. The data can be released to the public.

However, the volume of information that lends itself to data base approaches represents an estimated 61% of GPO printing and procurement and could be extrapolated to represent all Federal Government "publishing". See Appendix 1.

With the proliferation of personal computers and other electronic workstations, it is expected that a majority of professional information consumers will have access to sufficient technology to utilize data in electronic form. Since 1980, for example, over 14 million personal computers have been installed worldwide, according to various industry estimates. In spite of this trend, it is still expected that there will be information consumers without access technology.

Electronic dissemination could be a byproduct of the conventional printing process (if proper composition techniques are utilized so that information may be re-formatted for re-use without re-keyboarding). In some cases the opposite can be true, in that printing, in various forms, is often a byproduct of electronic processes in that electronic data can be re-formatted and typeset in preparation for printing or directed to electronic printing devices for output on paper. Even though the volume of information suitable for electronic dissemination is not

overwhelming, according to our estimates, it is sufficient enough, and technologically easy enough, to provide to those who would benefit from it.

Any service and support entuty, such as GPO, with the responsibility for disseminating information should offer all viable formats.

B. GPO role in electronic dissemination (electronic formats).

GPO currently has no electronic dissemination except for a few items offered in magnetic tape format (e.g., Congressional Record, Federal Register). To what extent should GPO include a wide variety of electronic formats among its offerings, e.g., electronic data bases, bulletin boards, CD/ROMs, diskettes?

It is important to understand that the GPO does not only print or procure database-related materials. It is estimated that the following breakdown exists:

Potential Database-related 61%
- Record
- Register
- Hearings
- Bills
- Books
- Calendars
- Reports
- Publications
- Newsletters
- Codes
- Journals
- Documents
- Laws
- Regulations
- Manuals
- Speeches
- Gazette
- Patents
- Treaties

Non-database-related 39%
- Binders
- Forms
- Contracts
- Boxes
- Envelopes
- Folders
- Labels
- Posters
- Cards

Certificates
Letterheads
Pads
Tags
Signs
Pamphlets
Blueprints

Non-database-related materials exist only in printed form. Database-related materials could exist in either form. A database-related item, in our definition, is one that is most often text or tabular oriented. Graphics-related items do not presently have the flexibility and quasi-standardization of conversion and format.

Table 1

		Legislative	Non Legislative
		12.3%	87.7%
61%	Database-related	7.9%	53.1%
39%	Non database	4.4%	34.6%

Sources: See Appendix 1, FJR estimates.

A maximum of 61% of Federal Government work is potentially available for electronic distribution. Of that volume, 7.9% is Legislative and 53.1% is primarily Executive. The Legislative volume is mostly available in electronic form (magnetic tapes).

Recorded media and data conversion technology are relatively routine for most text and table information, so there is no major restriction in the ability of GPO or anyone else to address needs that might arise here.

Once data is in electronic form it is capable of conversion to a variety of formats for dissemination depending upon the needs of the market, the acceptance of the information consumer and the economic viability of any such provision.

Factors affecting electronic distribution include:

1. Timeliness of data.
2. Print and postal costs.
3. On-demand printout of selective data.
4. Ease of indexing and searching.
5. Cost of storage and inventory control.
6. Ability to develop data byproducts.
7. An evolving generation with computer skills.
8. Alternative formats for various audiences.

9. Tailoring of data to individual needs.

Yet, traditional print will continue to be required, because:

1. It's portable.
2. It's user friendly.
3. It's easy to acquire.
4. It's clearly protectable by copyright.
5. Its content is stable.
6. It requires no technology for access.
7. It's low cost.

The Library of Congress presently has less than 5% of its publications available in electronic form only, and according to a Printing Industries of America study, it is not expected that this percentage will increase significantly in the future. About 25% of LOC publications are in both print and electronic form. The PIA study predicts the following mix of media by 1990:

Table 2

Print Only	80% to 90%
Print and Electronic	10% to 20%
Electronic Only	5% to 10%

GPO should release data in appropriate electronic forms where economically and technologically feasable. However, printed formats will continue to exist.

C. GPO role in electronic input.

GPO currently receives about 70% of its input by magnetic tape, with a small percentage on diskette and a few direct electronic input pilot projects underway. To what extent should GPO shift to a greater reliance on diskette and direct electronic input?

It is important to understand what that "70%" is. Our analysis found the following data origination:

Table 3

Origination	Total	Leg	Non Leg
Key entry	26%	90%	10%
Scanned	5%	90%	10%
Mag Tape	52%	20%	80%
Floppy Disk	2%	2%	98%
Fiber Cable	10%	100%	--
Other Transmission	5%	15%	85%
Total	100%	52.9%	47.1%

Source: GPO reply to FJR questions.

The above only applies to information which GPO typesets. What is more interesting is the following:

Table 4

Origination	Leg	Non Leg	Total
Artwork	.5%	24.5%	25%
Other methods	49.5%	25.5%	75%
Total	50.0%	50.0%	100%

Source: GPO replies to FJR questions; FJR estimates.

"Artwork" in the above chart means that a GPO "customer" (most often an Executive agency) has provided pages to GPO that are camera ready, that is, in a form that does not require typesetting and page composition by GPO. We estimate that 25% of GPO work is being prepared by agency "customers" and presented for printing in page form. Pages supplied by these "customers" have to be produced somewhere, somehow. They can be as simple as pages printed out on a word processing printer or as complex as typeset pasteups. Using a base of 11,920 Federal Government entities (Government Publisher database) in a random sample of 100 sites with other research surveys, estimates by the author include the following for origination of the majority of their published pages:

Table 5

			Trend
Govt entity		89%	
Desktop Publishing	8%		Up
Electronic Publishing	6%		Up
Traditional Typesetting	25%		Down
ADP	20%		Stable
Word Processing	26%		Stable
Other	4%		Down
Contractor/GPO		11%	
Total		100%	

Source: Random sample survey of Government Publisher data base, FJR estimates.

It should be noted that many entities use a variety of these approaches depending on the nature of the publication. Thus ADP may be used to generate statistical data and Traditional Typesetting may be used for the accompanying text, for example.

These "customer-supplied" pages are produced in electronic or partially electronic form. That is, every form of typesetting or word processing generates an electronic medium or coded file. If stored and formatted in a standardized manner, the underlying data could be used for other purposes, e.g. interface to data bases, electronic printing, pre-press or electronic distribution.

It is our opinion, based on these estimates, that the percentage of supplied camera ready pages is increasing.

D. GPO role in electronic printing/publishing.

GPO currently has several electronic photocomposition units plus a large array of conventional binding and printing equipment; at present, GPO does not offer electronic printing or printing-on-demand services, except in a small number of pilot projects; some agencies have high-end electronic publishing equipment and many apparently have desktop publishing systems. Should GPO expand its own role in support of agency electronic publishing?

Let us clarify the term "electronic publishing" since it has two meanings. The original meaning had to do with the dissemination of information in a form that was not paper oriented: video, microfilm, microfiche, terminal, magnetic media, bulletin board, etc. For all of these competing approaches, paper printout was an optional capability. The concept assumed that electronic search and query systems would allow users to select only the specific data required and print it out on paper -- usually pages or sections but not the entire publication.

The second definition of electronic publishing evolved with the advent of new systems for the typographic preparation of pages. In 1980, the higher resolution monitor, 32-bit microcomputer, multi-tasking operating system, "portable" software languages and raster scanning/imaging combined to create a new type of hardware/software "system" that allowed users to put pages together, integrating text and line art graphics, without manual methods. The word "publishing" lost its real meaning and was subverted to define a level of technology concerned with page preparation.

Today there are two levels to this area:

1. Desktop Publishing, which refers to the application software added to standard personal computers (with laser printers) to produce pages in typographic form, and,
2. Electronic Publishing, which refers to more sophisticated hardware and software for typographic page production of more complex pages in higher volume.

With the advent of the latter technology pages could be assembled more rapidly. As a result of raster-based printout of pages, pages stored in these systems could be printed out as required. Or the data could be converted for electronic publishing for electronic distribution.

Throughout this report, the term "electronic publishing" means page producing or processing systems or programs, and the term "electronic distribution or dissemination" is used for non paper uses, primarily.

GPO and JCP have done little to support agencies that desired to implement electronic publishing, citing manpower shortages in most cases. We estimate that there are a significant number of pages that are being produced as "artwork" by GPO customers using this technology.

There has been no centralized source of information for these users in regards to the selection and implementation of electronic publishing technology. It is estimated that Executive branch agencies in total spend at least $350,000 - $450,000 a year on seminars, publications and trade show visits (FJR estimate), not including personnel time, in order to keep up on new publishing technology.

<u>To what extent should GPO offer electronic printing-on-demand service</u>

See Appendix 3 for a discussion of demand printing and publishing. Demand printing presently works best for low page count documents. GPO work volume printed at the central office is:

Table 6

	GPO	All Gov't*	Average*
10 pages or less	9%	13%	11%
11-50 pages	23%	30%	26%
51-100 pages	25%	37%	31%
101-250 pages	20%	10%	15%
251-499 pages	15%	5%	10%
500 pages or more	8%	5%	7%

Source: GPO estimates; *FJR estimates

57% of the documents and publications processed by GPO are 100 pages or less in length. Our estimates for "All Gov't" include work done at agency printing and copying sites and total 80% for the same range. Averaging the two areas together yields 68%. Although our report is to cover GPO we felt that this estimate might be useful. This is the area that lends itself to electronic printing approaches. As an increasing amount of information becomes available in electronic form, demand printing becomes a virtual necessity in order to cut storage, re-printing and waste.

The most viable application of demand printing is printout of specific pages within documents or publications, rather than production of the entire document or publication by electronic means.

As an example, the printing of Census materials (usually one or more volumes per state) requires substantial printing and storage. Demand for each state's data is erratic and certain states may require reprints while others are later discarded. Usually, a requester is seeking a specific piece of information. The use of an electronic system to search the data base and then print the page or pages as required can save printing and storage as well as shipping costs and the personnel necessary to control all these aspects.

However, data that is available from the Federal Government that can be printed on demand is estimated at less than half the volume of present printing volume. NTIS materials appear to be better suited to electronic printing than GPO documents.

and/or provide leadership with respect to desktop publishing?

Someone must provide a leadership role. We estimate that 35% - 45% of all Federal Government agencies will have some level of desktop publishing by the end of 1988. The Our interpretation of the GAO survey (Q.5 Pg.10) found that 8% of the survey population was already using desktop publishing and 33% of the population was prototyping it. The nature of the question and the manner in which it was answered may affect the result; however, our interpretation is in line with other surveys and research that we have performed.

More importantly 45.5% of the survey population is now using some form of publishing or printing technology and 16% are in the prototype stage (GAO data, FJR estimates).

If at least half of all government agency locations could have desktop publishing by the end of 1988 and 60% could have it by the end of 1989, there will exist an eclectic base of publishing technology that has been implemented without standards for interfacing, training, etc.

As word processing technology is replaced by personal computers, it is a relatively simple task to add publishing functionality to the PC for less than $600. Almost every major Federal Government office has word processing of some kind:

Table 7

Dedicated	54%
Personal Computer	41%
Mainframe-based	5%

Source: TypeWorld database; FJR estimates.

Some locations have more than one type. Because of the low bidder purchasing process, it is not unusual to walk though a government office and find several different word processing devices and systems, most of which cannot "talk" to one another. Since older dedicated systems are not being sold or supported at present, most users will migrate to PCs. They will probably use low-cost laser printers as printout. The PC and the laser printer are also 90% of a desktop publishing system.

Should GPO adopt industry standards for page makeup, page description, and transmission instead of or in addition to traditional GPO standards?

GPO or JCP or someone must respond faster to technological trends that affect standards. Standardized page description languages such as PostScript and PCL (Hewlett-Packard) have been in use since 1984:

Table 8

PDL in use	Units in U.S.	Est. in Gov't
H-P PCL	210,000	29,000
PostScript	420,000	14,000
Proprietary		
Printer	790,000	67,000
Typesetter	125,000	8,700
Other Laser	45,000	11,000
Total	1,590,000	127,000

Source: TypeWorld data base; FJR estimates (to end of 1987)

Estimates for page makeup (desktop publishing programs) are:

Table 9

Program in use	Units in U.S.	Est. in Gov't
Aldus PageMaker	115,000	6,000
Xerox Ventura	85,000	12,000
All others	66,000	3,000
Total	226,000	21,000

Source: TypeWorld data base; FJR estimates

It should be noted that the majority of laser printers are being driven by word processing programs, most of which have very strong capabilities for page processing. About 200 - 350 or 8% of the base of larger printout devices (in terms of speed, volume or format -- such as the Xerox 9700 and IBM 3800 families of devices) are estimated to be in government use (TypeWorld data base, FJR estimates). These units are being used for electronic printing in many cases, since they operate at speeds in excess of 100 pages per minute to printout pages for distribution. One does not invest in such a device (over $400,000) to merely replace a computer printer.

No data exists as to the exact nature of the material being output; however, in those cases where the pages are not "personalized" and the device is operating as a "printing press" for runs over 1,000 copies per page, it would be much more effi-

cient if the data could be provided to GPO for higher-speed or higher-quality printout and links into the pre-press process for signature printing.

E. GPO role with respect to mission agencies.

Most mission agencies currently work through GPO for conventional printing, unless they have an approved exception from JCP for agency in-plant or contracted printing, although the legal basis for this arrangement is in dispute.

To what extent should GPO extend its working relationships with agencies to include electronic as well as conventional printing, and electronic as well as paper formats, and if so, should this be on a mandatory or voluntary basis?

There is no such thing as a voluntary standard. Standards for coding, manning, productivity, networking, etc. only exist because they are imposed. Voluntary relationships will not accomplish the degree of standardization necessary to link agencies to in-plant printing or to outside vendors or other agencies. There has been no government-wide definition, supervision or control of publishing technology, especially since it reached the desktop level. Yet, it is here that standards are essential.

Many agencies have felt that JCP's subjective definition that "any device that prints out a character should fall under the province of printing" (JCP representatives to FJR, 1985) -- thereby including virtually any printout technology -- is too broad. Title 44 was written at a time when printing was based on hot metal typesetting, letterpress printing and union domination of the process. Certainly, one would not want to have decentralization of printing with those labor-intensive technologies. Today, automation has reduced labor substantially, technologies for reproduction and typesetting are more "office" oriented and there is no control by any organized group over the processes involved.

PC-based technologies have given agency originators alternatives, but in their haste to be "free" of JCP rules and GPO centralization, the agencies themselves may have lost sight of larger issues -- standards, file passing, interfacing and links to the printing process. Each agency solves its own problems without regard to larger issues of electronic distribution -- because there are no guidelines.

Should GPO adopt a voluntary posture even with respect to conventional printing?

There is an important relationship between print procurement and an in-plant printing operation, if they exist within the same infrastructure. The in-plant printing operation cannot allow individual "customers" to place conventional printing with outside services directly without upsetting the very foundation of procurement processes and their inter-relationship with the in-plant printing philosophy. That philosophy says that the in-plant facility must be able to select the work that is most appropriate for its equipment, personnel, etc.

A commercial printer does not know from day to day what kind of work will come in the door. This is why some commercial printers specialize -- in books, magazines, catalogs, etc. The high-profit printers, those with a profit of 8% or more on sales, tend to specialization, an approach advocated by the Printing Industries of America and supported by their annual ratio studies. It is much more efficient, and therefore productive, to run similiar jobs (same sheet size, paper type, ink color) in sequence. If that sequence is broken because the press has to be re-configured for a rush job, or paper changed, or binder line re-configured, efficiency is lost.

An in-plant facility establishes its capability based on definable workloads within the organization. It must therefore have access to all jobs so as to select those that are appropriate because of format, schedule or other aspects for in-plant production. If printing work is procured by a number of entities, this selection option is lost and equipment and personnel would sit idle.

Centralization of procurement is essential in order to minimize conflict of interest, utilize specialized personnel more efficiently and maintain a data base for control, reference and pattern tracking. The latter items do not exist at present at GPO but should be implemented to maintain data for decisionmaking. GPO cannot properly track complaints due to quality or delivery or to reference other anomalies in deliverable products so as to better select suppliers on the basis of their record. If procurement was decentralized, one would not even have this ability.

The procurement of printing is a specialized process. Major insurance companies, for example, have separate print purchasing as an entity within their purchasing departments. John Hancock Insurance in Boston is typical in that the print purchasing group is part of the in-plant printing and copying group. Knowledge of paper, inks, presses, processes and many variables is essential. Finding and maintaining such skill for a large number of decentralized departments is less effective than centralizing it under one group of skilled professionals.

GPO appears to have allowed direct procurement where the work would not be applicable to its capability. There are many print professionals in the Federal Government but it would be imprudent to assume that every entity that needs printing will have such a professional available to them unless there was a centralized resource.

F. GPO role with respect to separation of powers.

GPO currently is a legislative branch entity serving all 3 branches of the Federal Government. This has proven to be controversial in some quarters at least with respect to the executive branch. Should the GPO role be limited to the legislative (and judicial?) branch, or should GPO be converted into an executive branch agency?

For FY86 GPO in-plant and procured printing, with respect to its "customers" was:

Table 10

Legislative	Judicial	Executive	Total
12.3%	.3%	87.4%	100%
$95.0MM	$2.3MM	$673.4MM	$770.6MM

Source: GPO reports. Federal Register allocated to Executive. Although there are Legislative materials (such as riders) that are billed to other branches, the percentages are not expected to change these relationships substantially.

It is apparent that the GPO "boss" is Congress but that is not the biggest "customer", just the most important. That is confirmed by the work that is done internally at the central office -- that is, printed with the fastest turnaround.

Table 11

	12.3% Legislative	87.4% Executive
23.4% Central Off	2.9%	20.4%
1.8% Regional Off	.2%	1.6%
74.8% Procured	9.2%	65.4%

(Judical volume is .3%)
Source: GPO reports

Overall, 23.4% of all government printing is done at the central office and under 2% is done at the regional offices. The balance -- 74.8% -- is procured printing.

The bulk of the work handled by GPO is non legislative. In fact, looking at the numbers, the GPO is a defacto Executive branch agency.

However, for reasons provided later, an in-plant printing facility must have access to all workload in order to select applicable jobs for its capability level. To turn the situation around and have an Executive facility controlling Legislative work may be arguable as well -- although the volume level for the Legislative work is substantially lower compared to the Executive level.

When one looks at in-plant printing (central office and regional offices), one notes that Legislative work is not dominant:

One hypothesis would suggest that GPO should therefore become an Executive-controlled entity. It would then have the ability to manage printing procurement with professionals and have access to the workload for in-plant capability levels. GSA is certainly qualified to manage existing procurement staffs.

As Congress continues its conversion to electronic methodologies, it may rely less on conventional printing, but it will still need to release some volume via print and will therefore have to maintain some level of printing technology. Given

the number of pages in some Congressional publications, signature printing is the most cost-effective reproduction approach now and will probably remain so until electronic printing can handle signature size sheets -- perhaps 5 to 10 years away.

G. GPO role with respect to NTIS.

Should the two agencies be combined and if so, how--executive agency, legislative agency, private contractor, government corporation?

Centralization of marketing and administrative support for information sales is a logical approach. One marketing organization is usually more cost effective than two marketing organizations. From a marketing standpoint, GPO and NTIS should be merged.

Duplication of effort in publishing production makes no sense in this case since there is no specialization at NTIS that mandates such duplication. NTIS is able to use more high-speed copier devices (rather than printing presses) and should consider conversion of its reports to optical disk (pure raster scanning) with electronic printer output. NTIS reports lend themselves to this approach since they are usually low in page count and printed on demand.

Since GPO or any other entity would have to evolve some of the same technology to meet demand printing requirements (electronic printers, optical disk production, reproduction technology and raster scanning), the combined volume would allow more sophisticated systems to be installed. From a technological standpoint, GPO and NTIS should be merged.

From both viewpoints, it makes no sense to have duplication of effort. One marketing/production entity could handle both the GPO and NTIS at less cost than two separate entities.

H. GPO relationships with the private sector.

GPO currently contracts out about 75% of printing to the private sector, and almost all executive branch work. If GPO provides electronic dissemination services, should GPO continue to contract out the work,

GPO or some other entity will have to contract out printed work. As noted, there is still a large percentage of printing that does not lend itself to electronic publishing or distribution.

Table 12

	Commercial Procurement	Central & Req. Office	Total
All	74.8%	25.2%	100.0%
Non Elec.	59.0%	10.0%	69.0%
Electronic	15.8%	15.2%	31.0%

Source: FJR estimates.

39% of all GPO work is not database related at all and the balance of potentially available material -- 61% -- contains a volume that is not releasable in electronic form -- estimated at 30%. Thus, only about 31% of GPO printing and procurement materials may be capable of electronic approaches for distribution.

GPO will thus continue to contract out work since the bulk of it will be print related rather than non-print related.

do some work itself,

If there is an in-plant facility, for any reason or any branch of government, it will have excess capacity.

12.3% of all GPO printing and procurement is Legislative and it is doubtful that any commercial service could produce it as rapidly and as cost-effectively as the GPO -- unless it dedicated the level of manpower and made the capital investment in equipment. For instance, the GPO bindery facility is specifically established for Legislative work and it would require a capital investment of several million dollars for a commercial firm to equal the present level. Without such capability a commercial service would be at a disadvantage. And finding other customers for that specific functionality may be difficult in that GPO work volume is rather unique.

GPO is cost effective only when viewed in the totality of its in-plant printing, which includes what is called "filler" work -- materials that are suited to the capability and schedule levels of the GPO to fill in the idle time for equipment used for Legislative work. This is not to trivialize any of the work. Most printing services establish a functional capability level for primary work types -- all other work is then classified as filler. In fact some commercial services consider government contract work to be "filler".

Remove the filler work and virtually all printing systems would not be cost effective because of the adverse effects of equipment and personnel downtime. It should be noted that the Federal Register is an Executive product and is handled as a primary priority product with most of the Legislative materials.

As long as there is a government in-plant printing facility for quick turnaround documents and publications, there will be excess capacity which can be filled with

other government work. Also, as stated elsewhere, when one analyzes the entire workload it may be that only about one third is eligible for electronic dissemination.

or do all the work inhouse at least for selected priority information products?

That is essentially what is being done now. Certain materials are completely handled inhouse because of confidentiality, turnaround, specialization or "applicability".

To have the productive capacity to handle the items listed would result in a physical plant and equipment/technology capacity that would then sit idle most of the time. This is certainly an option if it is understood that the manpower and other resources are already paid for and the only cost to government to use them for filler work would be the paper and ink (and a small amount of general overhead) applied to individual jobs. Executive "customers" object to their work being characterized or treated as filler; yet, if the Executive branch controlled GPO, the bulk of the volume would still be Executive and the bulk of the filler would still be Executive. Only then an Executive administrator would make a determination, not a Legislative administrator.

GPO is presently controlled by Congress but GPO only prints under $90 million in fast turnaround documents and publications for Congress. This is only a fraction of the $770.6 million in GPO billing. Let's look at two scenarios that illustrate the impact of this approach.

By using the ratio studies of the Printing Industries of America for the largest web and sheetfed press plants, we can compare GPO to the commercial sector. Commercial labor would be considered as fixed because employees are not laid off when there is no work present. Paper averages 34.5% of a job and other chargeable materials average 7.5% for a total of 42%. Adding 2% for other variable costs, such as power, etc. it can be seen that 66% of the cost of any job would remain if the equipment sat idle. To state this point another way: filler work essentially costs only 34 cents of the dollar. Of course, that is cost, not selling price. At GPO, we estimate that the filler work might cost between 30 cents and 38 cents, so compared to the commercial sector GPO does provide reduced costs for the American taxpayer.

GPO is geared up to handle overnight turnaround of certain Legislative materials, representing $86.9 million or 48.2% of its total in-plant printing of $180.3 million. That means that the remaining $93.4 million is filler work. This work is selected from all the material available to GPO as applicable for the in-plant capacity available. This includes the Federal Register at $17.7 million, passports at $2.2 million, and postal cards at $3.6 million. There is also $19.3 million in blank paper sold to branches that is credited to the central office.

$42.8 million of the $93.4 million is accounted for by specialized products or services, leaving $50.6 million in what we have called filler work.

We provided our raw data to John C. Klasnic of Klasnic & Associates, a firm that specializes in in-plant and commercial printing. What effect does filler and other work have on the GPO cost structure? The reply:

"If the filler work was sent to outside services, its cost from the private sector would be 2.1 to 3.3 times higher than present GPO billings because 30% - 40% of all printing costs are job related (if no overtime is involved). The Legislative work that remained would increase slightly by 18.4% to 19.3%. Heat, light, overhead, etc. would remain but excess manning would still be present to handle the primary products and there would be fewer jobs to put those people on.

"The Legislative work, even though it would rise slightly in cost, would then reach a cost level where commercial printers could charge about as much as it cost GPO and make a profit. Right now, because of the economies generated by filler work, it costs less for the Legislative work. (Note that even though less than 20 U.S. commercial printers would now be competitive, they might have difficulty with the tunaround because they would not have as great a flexibility in selecting their filler work as GPO.)

"Alternatively, if the Legislative work were sent outside, it would increase by 1.4 to 1.8 times over GPO costs with filler work and 1.9 to 2.3 times without filler work because of the logistics of maintaining costly open equipment time to meet tight governmental requirements. This can be substantiated by comparison with commercial sector commercial printers who typically charge three times the applicable industry competitive rates because of time contraints. Forms printers typically charge X$ for normal 6-week delivery and 2X$ for 1-week delivery. If only filler work were retained it would cost 9.6% to 9.9% more since it would have to absorb a larger share of the overhead."

In either case, there would be an increase in cost. It is the relationship between primary and filler product materials that keeps the GPO reasonably cost effective. Remove or modify either product and the cost equation changes.

The volume of data that can be disseminated electronically is estimated at 31% out of a potential 61% of GPO printed or procured volume -- probably too low to make any appreciable impact on the agency or the GPO.

<u>In general, how should GPO relationships evolve with respect to business users,</u>

Any organization that uses government data for re-sale and profit should pay a fair price for that data. Outside services that re-keyboard or scan Congressional Record copy to get it into a database must pay a high price for conversion but recoup it after re-sale because of the value added of availability in electronic form. To hear that there was complaint about the $27,000 charge for magnetic tapes of the Congressional Record as too high is absurd. The savings for any organization that re-sells that data is significant. It would have to either re-key, or OCR scan it and then perform some level of verification and possibly correction to get it into electronic form. With a GPO tape, the data is immediately ready for conventional use.

Charges for electronic media should be based on a true cost allocation. We estimate that it costs the GPO between $9.30 and $10.02 per page to create the data base and typeset one page of the Record. This does not include the cost of collecting the information before it is provided to GPO for production. True cost allocation should be charged to anyone who wants the Record in electronic form,

not merely the cost of the media and run time -- they are merely the tip of the iceberg. Re-sellers make a profit from information that is essentially free, even though taxpayers paid for the acquisition of that information.

equipment suppliers,

There were no areas in this regard that appeared atypical. GPO is a major customer of equipment, supply and other vendors.

and information suppliers as well as printing companies?

Information suppliers receive real bargains in regard to government data. It costs very little to acquire and can be re-sold many times without royalty. Usually, publishers have a cost for information acquisition that must be included in their overhead. With government data, they have no real acquisition cost, just a conversion cost. And there are no royalties.

Electronic data is available in many cases, which reduces the cost of conversion to electronic form by the re-seller. If Federal Government data was not available in electronic form, re-sellers would have to convert it to electronic form through Optical Character Recognition or re-keyboarding.

GPO relationships with commercial printers are typically love-hate. Commercial printers view any in-plant printing facility as a competitor, yet in-plant facilities exist because of the inadequacies in commercial printing. No printing service can provide the best cost or turnaround to every customer that comes to them. Cost is a factor of volume (the higher the volume, the lower the cost usually) but high volume affects turnaround adversely.

The Federal Government is one of the largest single customers of the commercial printing industry.

Key GPO Alternatives

A. Status quo.

This is not an option. If no action was taken, GPO would still evolve into new technology and new approaches.

B. Electronic GPO/Centralized.

GPO would continue its traditional role with respect to conventional printing and extend this role to include a centralized dissemination function for electronic as well as paper formats; make maximum appropriate internal use of electronic printing and provide support for electronic publishing in agencies; develop and maintain an index to Government information (all formats); adopt and mandate the use of standards for page makeup, description, and transmission and for printing management; and continue to serve all branches of government.

This is what GPO is becoming. The nature of an in-plant printing facility mandates most of this approach. Once there is control of printed information, there is control of the underlying data that creates that printing.

But, as already shown, and repeated throughout this report, the volume of data applicable for GPO to become a primarily electronic entity is very low. 61% is database-related and of that only about 31% may be applicable for electronic distribution.

All other areas must be addressed to keep government information dissemination efficient and cost effective.

C. Electronic GPO/Decentralized.

Here, GPO would carry out the functions listed above for alternative B except that electronic dissemination and electronic publishing activities would be handled on a decentralized basis. That is, irrespective of what electronic format items GPO might choose to include in the GPO sales/dissemination program, agencies would continue to directly disseminate electronic formats. (Agencies could opt to let GPO handle electronic dissemination, but this would be at agency discretion.) Likewise, regardless of what electronic services GPO might choose to offer, agencies could use electronic publishing (desktop to high-end) in accordance with their own needs. GPO would develop and maintain an index to Government information (all formats) by consolidating indices provided by the agencies. GPO would adopt and mandate the use of standards for page makeup, description, and transmission and for printing management.

Some agencies are already making their data available in electronic form. In the GAO survey, less than 5% of the 149 respondents that we reviewed had responsibility to provide access to databases (Q. 13, Pg. 20). However, 63 of them had databases that contained public information -- representing 703 databases (Q.21, Pg. 24) of which most were already available to the public (Q. 22, Pg. 24). It is interesting to note that the sites with the data bases did the most paper publishing (FJR estimates).

One must contrast this data with the fact that the overwhelming number of respondents did not have data bases but still required printing.

It is instructive to review the argument between centralization and decentralization. From an organizational perspective, centralization is best since it integrates high levels of technology and personnel in one location. This allows the use of the best equipment and the best skills, which might not be justifiable for lower volume locations.

However, centralization often breeds contempt since all work must be assigned priority and some work will not be produced as rapidly as the "customer" may want it. This results from competition for available resources by many jobs with varying characteristics and schedule requirements. Usually, low volume, fast turnaround, relatively simple jobs are handled on a decentralized basis.

Every business entity attempts to balance the organizational issues of centralization with the "departmental" issues of decentralization. Management tends

to centralize for efficiency; departmental work groups tend to decentralization so they do not have to wait in line for production. Neither approach works well when it is the only approach. Decentralization results in duplication of effort, low utilization of equipment (most agency plants are on one shift), and higher costs per unit of production. Positive aspects include faster turnaround of materials to meet agency publishing mission and higher levels of security.

Centralization results in higher utilization of equipment (GPO is on three shifts), maximization of manpower, and lower costs per unit of production. Negative aspects include missed or long schedules because of volume and priority issues.

D. Electronic Legislative Branch GPO.

Here, GPO would carry out all the functions listed above for alternative B except for the legislative branch only (plus a few key governmental process items, such as the Federal Register, passports, postal cards). GPO would continue its cataloging functions and the development and maintenance of an index to Government information (all formats) by consolidating indices provided by the various agencies, as above. GPO printing contracting functions for executive branch work would be transferred to GSA. GPO standards setting functions for executive branch work would be transferred to NBS. Mission agencies would work with GSA for conventional printing and with inhouse experts, GSA, NBS, NTIS, etc. for electronic dissemination.

A totally electronic system would allow Legislative access to all information via terminals with on-demand electronic printing of pages as required. Since the printing of the Legislative materials drives the entire GPO system (one of the smallest "customers" controls the process), and since the run length of most Legislative materials is very short (only a small audience needs access), and since on-line terminals would allow faster access, an electronic Legislative GPO is a reasonable alternative. However, there are audiences that will not have access to the technology and would still require print. Although run lengths are short, page volume is high on most Legislative materials.

A GPO summary report called "Congressional Publications" shows that the vast majority of Legislative materials are short run in nature. Since most Legislative materials are already in electronic form -- they are typeset through the GPO -- this option could be accomplished more rapidly. Systems access, database design and remote printing capability need to be implemented, all of which are technologically mature approaches.

The necessity for any level of printing capability would still require substantial manning and equipment cost. Legislative work could not be removed from GPO entirely. Thus, if some volume of work was removed from GPO, it would upset the balance that exists between priority work and filler work. At that point, merging NTIS volume into the fold would make the resulting entity more cost justifiable.

Here are our reasons:

1. A good portion of Legislative material is already in electronic form.
2. The audience for this material is small -- mostly Congress and its committees (50.3%) -- although many of these are given away by Congress to libraries, media, etc., legal (6.8%), depository libraries (4.4%), subscriptions and sales (14.6%), the press (.9%) and others.
3. Only 21,694 copies of the Congressional Record are distributed. Most other Legislative materials have an much smaller distribution.
4. If all of this material were available through a data base and on-line terminals (PCs included) so that searches could be made and only specific pages printed out, the print run could drop by a maximum of 24% in the first year and 52% within two years (FJR estimates). Further cuts could be made by reducing the number of copies distributed free.
5. If one reduced print runs by half, for example, the workforce necessary to create the data base (typesetting and proofreading) would still be required no matter what the print run was. The pre-press preparation force would also be unaffected by the print run. These two areas have functions that are not a factor of run length. There would be a slight reduction in press and bindery (no more than 15% - 20%) and a significant reduction in paper and postage.
6. Congress does not meet every day of the year but personnel cannot be laid off, re-hired, etc. for peaks and valleys. A workforce must be established to handle the volume and it will have periods of high Legislative volume and periods of low or no Legislative volume. Virtually all commercial printers would have difficulty with this type of workload. It would be almost impossible to satisfy the secondary level of customers for such a service.
7. It is still expected that for at least the next decade there will be some body of people who will not have access to or desire to use electronic technology, and paper printing will be required.
8. Even if all electronic distribution of Legislative materials was possible, there would still be the need for manpower to create the database. This staff would still have peak and valley periods.

One could not eliminate the GPO by creating an electronic Legislative branch so long as printing was still required. And even with electronic approaches, the impact on GPO would not be sufficiently beneficial.

E. Electronic GPO-NTIS Consolidation/Centralized.

Here, GPO functions would be combined with those of NTIS and the consolidated agency would carry out functions listed above for alternative B.

Comments above apply here as well.
GPO should be applying some technology for short-run electronic printing, if only as an R&D function in order to determine costs, procedures, etc. One of the limitations of electronic printing is the ability to efficiently bind small numbers of sheets into units. There will be the need for specialized equipment. To justify such equipment, Legislative volume may not be adequate. NTIS volume may not be adequate. But both could be combined to provide such justification.

The same may be said of Executive volumes. Applicable work types from agency printing and copying sites could be combined to apply more efficient centralized technology.

F. Electronic GPO-NTIS Consolidation/Decentralized.

Here, GPO functions would be combined with those of NTIS and the consolidated agency would carry out functions listed above for alternative C.

It is more likely that B and C would be in effect at the same time. The volume of electronic data at the agency level is not sufficient to allow a totally electronic or decentralized approach.

G. Sensitivity analyses.

Under alternatives B, C, E or F, GPO or the consolidated GPO-NTIS could be converted to an independent executive branch agency and/or could be given a new name such as Government Information Office (GIO).

GPO is essentially an Executive branch agency now. The entire infrastructure could be placed under GSA.

Pros:
1. Retains in-plant printing/procurement structure.
2. Places control with largest "customer" group.
3. Would still be responsible for priority Legislative work, similiar to present responsibility to meet Federal Register priority for Executive.
4. Could remove some conflicts with ADP "jurisdiction" since both areas would be under Executive.
5. No major effect on labor or procedures.
6. Reduce conflicts between two branches of government so long as Legislative work receives its present priority.
7. Retains centralization philosophy which reduces duplication of effort.

Cons:
1. Loss of or reduced direct control by Congress.

Any change in the name of GPO would be purely cosmetic since its role in dissemination of Federal Government information would not change appreciably. For 125 years the GPO has been primarily a printing service. We expect it to remain as such for at least the next 20 years in spite of the proliferation of new technology.

Under all alternatives, congressional oversight mechanisms could be reorganized (e.g., establishing a Joint Committee on Government Information, establishing

new subcommittees of existing House and Senate committees). Under alternative D, a separate executive branch printing office could be established (e.g., as part of GSA).

As stated above, direct control of the present organization could pass to the Executive branch. Congress would still have oversight as it does with other Executive areas. It would make little sense to separate the Legislative work into another entity. All efficiencies arise from the integration of all government work. Even if the Legislative material that could be released in electronic form was so oriented, there would still be the need for conventional printing for those audiences that could not utilize the data in electronic form.

The page volume of many Legislative items is too high for electronic printing and limitations on sheet size and duplexing could actually increase cost. If there must be conventional Legislative printing, it should be combined with all government printing.

The creation of a Legislative-only facility would result in duplication of effort and higher cost per unit of production.

Under all alternatives (except the status quo), GPO or the equivalent could be converted to a government corporation or private contractor.

If you removed the procurement function from GPO, what is left is $194.6 million in printing (central and regional plants). Since the private organization would not have access to the procured printing volume -- this volume would still go out for bidding we would assume -- the private entity would lack needed filler work where the work's required schedule could be controlled to maintain a facility and labor force at productive levels.

There are only 36 printing firms in the United States with sales over $194 million (Printing Impressions, December 1987). Of these, 10 specialize in business forms, 3 specialize in greeting cards, and 2 in packaging. The remaining 21 firms (three of which are foreign owned) are somewhat diversified, but primarily advertising and publications oriented with some book work. The vast majority are not unionized.

For such a privatized entity to be profitable it would have to have access to, and control of, the filler work. Without it, the cost of operation to provide the Legislative priority work would have to increase.

There are no examples of privatized situations that might be instructive. The GPO is analagous to one of those self-contained ecosystems. It functions at some level of efficiency because it achieves a balance between priority and non-priority work, within a closed-loop environment, because it has mandated control over the workflow. It is doubtful that such control would be mandated to a private organization, negating the bidding process.

Evaluation of Alternatives

A. Underlying assumptions (for evaluating all alternatives).

1. Demand for Federal information.

What is the breakdown of the GPO market by user group and type of information product?

The user communities for government data vary widely. We estimate that most data released by the Federal Government has a large number of small audiences.

We estimate that 41% of the work printed or procured by GPO is for inter-government use and may not be disseminated to other outside audiences:

Table 13

Military	33.3%
Other Gov't	7.7%
Libraries	16.0%
Other	43.0%

Source: GPO reports where applicable; FJR estimates

Thus 59% of the total GPO printed and procured volume is potentially available for electronic distribution outside the Federal Government based on this estimate.

Based on 9,302 1985 GPO orders, the average government publication was 132 pages with a print run between 2,900 and 4,040 (GPO data).

This is truly short-run (conventional) printing and falls just outside the run lengths for copier-based or electronic printing devices (presently under 1,000 run lengths). Conventional printing carries a high preparatory burden -- composition, camera work, imposition for signatures, platemaking and press makeready -- before the first useable sheet comes off the printing press. To illustrate this point, one should understand the dynamics of the printing process in terms of the effect of run length (number of copies) on each function:

Function	Affected by run length
Composition	No
Camera	No
Platemaking	No
Film	No
Plates	No
Press makeready	No
Press running	Yes
Bindery setup	No

Bindery running	Yes
Paper	Yes
Ink	Yes

It can be seen that most costs are independent of run length. To only reduce the quantity would increase the cost of production (although there could be offsetting savings in postage, warehousing, etc.). Electronic approaches must eliminate printing runs, not merely reduce them, to have a major effect on overall cost.

Short run lengths therefore carry a higher cost per copy than longer run lengths -- since the latter allow greater distribution of the preparatory cost. Electronic printing -- whether it be office copiers that take "artwork" pages or computer-aided printers that combine a typesetting-like function with a reproduction function -- do not have the preparatory requirement. However, they must print one page at a time, with some duplexing and sorting. The consumable (toner) is higher in cost than printing ink.

Comparison:

Table 14

Conventional Printing	Copying	Electronic Printing
1. Signature oriented	Page	Page
2. High preparatory	Low	Low
3. High labor	Low	Low
4. Duplexing	Some	Some
5. Automated bindery	Some	Some
6. Few links to database	None	Many

Source: FJR

Detailed review of this volume might find that economies can be gained through better typographic presentation (more data per page) and better control of copy volume.

2. Demand for electronic formats.

Which of the traditional GPO market segments are amenable to electronic formats as a substitute or complement?

The major markets for electronic formats are:

Data re-sellers
Larger libraries
College/Universities
Research facilities

Larger businesses (Fortune 1000)
Specific professional communities
- Agriculture
- Health
- Education
- Finance
- Legal
- Safety
- Sciences

A survey of these audiences would be necessary to determine the level of present and projected electronic access technology. It is fair to say that some number will still require print formats.

What agency market segments could be served by an electronic GPO role?

In each of the audiences served by agency data some will be equipped to use the data directly and some will not -- it is presumptuous to assume that everyone will have a terminal of some kind. Printing on paper is extremely user friendly. Thus, these audiences may have to acquire or have access to the data through resellers, libraries or other services.

Since access would require specific equipment, some may not have access. Paper provides universal access. Thus, any planning for the future must assume that ink on paper or toner on paper will be a necessity -- albeit in lower volume.

Given the overwhelming paper orientation of agency information today, the need for a number of small audiences to acquire access technology, and the fact that print will still be required, we do not see major opportunities for non-print approaches, and in those cases where electronic distribution is possible, we do not see a sufficient reduction in conventional printing to have a positive economic benefit.

What new market segments might develop in response to electronic offerings?

New services will become available that integrate, index or extrapolate databases for sale to specific user communities or to provide new data paths for existing users. Indexing and computer professionals will develop high-speed methods for search and query so that users can request and/or directly access increasingly more sophisticated sorts and iterations of data.

The Apple Macintosh program "Hypercard" may be an embryonic function that all users of personal computers or on-line terminals will apply. It allows very high levels of searches/sorts -- it virtually allows users to navigate through data. It is possible that electronic indexing will augment print publications. Samuel Johnson said that there are two kinds of information: that which you know yourself and that which you can find because you know where to look.

Only in recent years has the GPO increased its marketing of paper formats, making a greater percentage of the U.S. population aware of available Federal information.

3. Technological advance.

Are there any technological barriers--from the perspective of the providers and/or users--to full service electronic offerings by the GPO, NTIS, or other Federal agencies?

There are no technological barriers to providing data in electronic form. Floppy disk conversion programs and devices can convert data into a variety of formats and operating systems, magnetic tape can also be converted among its various formats and telecommunications or bulletin boards require only ASCII files. Optical disk technology can either scan data or record it in ASCII and/or video/sound form. Typically, once data is available in one electronic format, it can be converted (at a price) into any other format.

One of the major obstacles/opportunities to data use will be routine conversion from one form to another form. We are over 30 years into the computer age and there are few generalized standards for information interchange, although there are some defacto standards, such as ASCII and EBCIDIC. To truly enter an electronic information age there will be the need for standards, and for a long time, the need for conversion of data.

60% of the GAO survey respondents (Q. 5, Pg. 11) utilized floppy disk or magnetic tape media.

However, in light of the technological trends and prognostications, every report that we have read on the future of printing and publishing clearly indicates that some volume of conventional printing will be required.

4. Standardization.

Are there any standards barriers--from the perspective of the providers and/or users--to full service electronic offerings by the GPO, NTIS, or other Federal agencies?

ASCII to EBCIDIC and back again is a routine "translation" for many mainframe computers today, for example. At the personal computer level there are more word processing and other programs than there are standardized conversions, although the more popular programs are well covered. Such translations, conversions, tables of equivalency, etc. are methods that allow data to be exchanged in a variety of formats.

However, graphics information is not yet standardized to a level that is reasonable. Government data consists of:

Table 15

Text	79.3%
Tables	11.8%
Line art	4.8%
Photographs	4.1%

Source: GPO estimates, FJR analyses

The major stumbling block to conversions is the number of word processing programs and the manner in which they are used. Some operators use the Tab key for indents and others use blank spaces. Software is available to convert WP data from program format to program format and translation tables can handle idiosyncratic keying. However, some degree of standardization -- a selected number of programs, recommended keying techniques -- would improve the ability for data to be used in a more seamless manner.

GPO presently has the capability of converting most floppy disk and word processing formats to a basic level of coding. This area should be expanded and users of word processing devices and/or systems should receive instructional materials on the preparation of copy for typographic printout, which is different than typewriter-like printout.

There should be some attempt to standardize on a small, select number of word processing, spreadsheet and other programs and to institute some basic level of training for operators.

5. Institutional infrastructure.

Are there any institutional barriers to full service electronic offerings by the GPO, NTIS, or other Federal agencies?

Other than confidentiality, there are no institutional barriers to electronic dissemination for the information that lends itself to such dissemination. There are no legal barriers to the distribution of information in different forms.

The major limitation will be the size of the audience that has, or will have, access. Even within the Federal Government there is no universal technology that would allow dissemination internally by totally electronic means.

6. Collection/creation of Federal information.

What are the basic trends in the collection/creation of Federal information?

In terms of page preparation, most government information is assembled in electronic form at present. Almost all agencies utilize ADP, word processing and specialized equipment to organize, assemble and finalize data for publishing. Some of it is database oriented and some is not.

We estimate that almost all Federal Government information for publishing is captured electronically at the agency level, but only a fraction of that is provided to GPO or contractors in electronic form for typesetting (perhaps less than 15%). 41% of the information is produced at the agency as camera-ready copy on desktop, electronic or traditional publishing equipment. (See Table in Section C.)

46% of the information at the agency level is captured in word processing or ADP form, some of it used as input to agency typesetting and some used as input to GPO.

Although we have no substantiation, we feel that a large volume of pages are printed with mono-spaced, typewriter-style characters. These pages are taken from word processing and ADP printers and used as "artwork" for conventional printing. Experience with specific agencies has shown this volume to be in the range of 14% - 21%, but we do not have sufficient data, nor does GPO, to confirm this for the government as a whole.

It is well known that typeset pages contain more characters than typewriter-style pages. Typesetting characters are proportionally spaced so there are more of them to a line. Moreover, they are more readable. Thus, the volume of pages that are not typeset could be cut by 30% to 40% by setting them in type. This action alone could have a substantial effect on the number of pages printed or copied within the Federal Government.

Is there any realistic prospect for significantly reduced Federal information collection/creation?

The use of inhouse (desktop and/or electronic) publishing technology, if properly configured and operated, has the potential to reduce costs in this area dramatically. Technology attempts to bring capability for page production as close to the originator (writer, editor, illustrator) as possible, therefore reducing the labor and time necessary to put pages together.

Reasons:

1. Information captured and edited on electronic devices -- faster than typing and re-typing on typewriters.
2. Output on laser typographic printers provides immediate page review -- no waiting for return from a service.
3. Revisions handled internally until page finalization -- no loss of time dealing with external service.

B. Major impact areas (to be considered for each alternative)

1. GPO workload.

What are reasonable estimates of the size and character (type of information products and services) of the GPO workload and rates of change over time?

Only minor changes in the volume or nature of products are predicted if GPO remains a printing-based entity. Based on the nature of the products produced or procured and the diverse audiences served, GPO will continue to be a printing-based service with certain alternative capabilities such as electronic printing and electronic dissemination.

The following matrix will probably remain constant:

Table 16

	1-color	2-color	3+-color
Legislative	30%	1%	--
All other	45%	19%	5%

Colors	Procured	Inhouse
1	59.8%	76.9%
2	20.2%	15.3%
3 or more	20.0%	6.8%

Source: GPO estimates

Certainly electronic approaches will continue to evolve.

2. GPO technology--conventional printing.

Is GPO's current conventional printing equipment adequate?

Yes, more than adequate. Web press technology is relatively stable. We support the acquisition of a newer web press that uses offset rather than letterpress printing. This will allow reduced manning and increase turnaround. It must be coupled with improved platemaking and this is being done through the use of technology that allows 70mm microfilm input to automatic plate burning and imposition. We would prefer to see the pages created directly from the output device onto 70mm film. GPO states that timeframes are a drawback to outputting more pages on 70mm, yet it would reduce cost substantially: outputting on photo paper, processing the pages, positioning them on a camera to expose 70mm film to be used in the platemaker/imposer. Although there are procedural and operational difficulties at present, these can and should be overcome.

Eventually, the goal of preparation technology is to go directly to imposed negatives or plates.

Some decisions in the press area were not understandable. The 5-color press comes standard as a 6-color unit and it has been the case that it costs more to get the version with less colors since there are two color units combined as one unit.

We also found it difficult to understand why the Opticopy camera/imposer would not be applicable. These are not vital areas, but decisions could be impacted by the pre-occupation with Legislative or specific work types.

To evaluate the state of GPO technology in composition, printing and binding, all major devices and systems were reviewed. The evaluation team consisted of Frank Romano, John Klasnic and Michael Bruno (the latter made a separate visit). Mr. Bruno is recognized as the leading international authority on printing technology. Mr. Klasnic is a specialist in inplant and commercial printing.

Composition: Front ends: GPO uses one of the original versions of the Atex (Division of Kodak) minicomputer text editing system. However, GPO maintains its own hardware and has modified the system to create and maintain databases. For the text work that is handled, the GPO Atex system is more than adequate.

Back ends: There are no competitive devices that have the speed and capability of the III (Information International Incorporated) Videocomp and Comp80 phototypesetters. Within the next few years it is expected that III will reduce support for these units. Many users are moving towards film plotters in order to handle color and some imposition. GPO performs its own maintenance.

Through the use of low cost laser printers, costs and time have been cut in proofing printout.

The Atex system is designed to handle large text files and is not appropriate for what is commonly called "job" work -- smaller tasks such as stationery, forms, etc. GPO presently utilizes a Compugraphic MCS system with its own phototypesetter, which replaces a Bedford system. For high-quality, complex composition (forms especially) or special projects we think that GPO should continue to explore additional alternatives here.

In spite of all this automation, and like most commercial firms, about 40% of the pages are "patched" with line revisions because of last minute changes, aesthetic problems or typographical errors. 87% of all printout is on photo paper, 10% on film negatives and 3% on microform (half 70mm and half 105mm).

Overall, composition capability is on a par with about 5% of the firms in the commercial sector. All equipment in this area is U.S. manufactured.

Pre-Press/Preparatory: This is one of the areas that has resisted automation. GPO has applied almost all of the devices or systems that attempt to automate the camera, stripping and platemaking areas. Roll-fed cameras, automated densitometry, automatic processing, automated imposition and automated platemaking. Pages are still stripped into signatures manually and in 10% of the cases art or illustration material is stripped in.

The Rachwal microfilm-to-plate systems save 80% of the cost of negative film used in manual stripping.

Suggested areas for continuing review: The older Lanston camera for larger formats is quite slow and should be considered for replacement by another Chemco roll-fed. An ECRM Autokon electronic camera would speed art sizing.

When the new publication press is installed, most of the letterpress platemaking equipment can be eliminated and the high labor associated with it can be reassigned.

Most equipment here is U.S. manufactured. Overall, capability in this area is on a par with about 18% of the commercial printing industry.

Press: Press capacity is excellent. Most offset press units were installed in 1977 or later. The new Record and Register press will produce more pages at one time (96 versus 64) and should improve efficiency substantially.

The only negative comment, made by Mr Bruno, was that the present letterpress Record press was dirtier when he saw it than it should be. Paper dust could accumulate and become a fire hazard.

The newer, larger presses are of foreign manufacture since most U.S. firms make newspaper rather than commercial web presses. Overall, capability in this area is on a par with about 11% of the commercial printing industry.

Bindery: This area is specifically established to handle "standardized" government publications and products. It would be difficult to compare to the private sector since there are almost no commercial services that have the product mix and schedule requirement that GPO has. Newer systems are foreign made.

Although there has been some process control automation, bindery is still mechanical rather than electronic and one of the most labor intensive parts of the printing process.

How does it compare with the private sector?

In press technology, based on its single-color work volume, the GPO is as well equipped as most commercial printing services. However, there are areas that could improve productivity and reduce manpower. Book printers, for instance, who use black ink primarily, pump the ink from a central reservoir to the press ink fountain, thereby reducing manual ink loading. GPO does this for its sheet-fed presses.

In bindery, GPO is substantially ahead of private sector firms.

In composition, GPO is on a par with about 5% of the commercial market.

It is not so much the equipment and technology as it is the ingrained procedural system that must be reviewed. Most consultants that have probed GPO in the last few years have been financial or general consultants without a specific understanding of the graphic arts processes. For instance, some of the overhead of the composition area is administrative -- people keeping track of jobs. Although there is electronic job tracking, we did observe people whose main jobs included stamping numbers or sorting manuscripts. These functions may be mandatory but should be reviewed. Bar code readers are going to be used to automate some of these functions.

Overall, GPO is well equipped to handle the publications and support materials that it has selected for its product mix. Unlike commercial firms, it has the "luxury" of selectivity of job type and can therefore build a production facility to match.

Are upgrades needed?

Improvement is and should be continuing. There will always be the need for upgrades to equipment and procedures. Most specific comments are included above. We were impressed with the progress GPO has shown in the last four years in bringing its capability up to state-of-the-art levels.

What is the potential for remote printing, use of satellite or other telecommunication links, and the like?

Remote printing would fall into two categories: electronic and conventional. For the latter, the transmission would result in a film negative that would allow platemaking on the receiving end followed by conventional printing. This is the method used by national magazines to bring the point of manufacture as close to the point of distribution as possible. Savings in time and postage are primary reasons.

For electronic printing, the data would be sent to the remote site for printout on intelligent printer/copiers. The limitations in page count and copy run in addition to bindery efficacy would affect this area.

The print runs at GPO are relatively short now. To move some of that volume off of highly capable press and bindery equipment to be sent to facilities that might not be as capable does not make sense. Remote printing is primarily applicable to products printed in massive numbers and distributed via the postal service to a very large audience. IRS booklets and forms are a good example of such products.

3. Agency technology--conventional printing.

Is the use of conventional printing technology by mission agencies currently at the appropriate level, e.g., only agencies with very high volume, high frequency press runs have their own equipment--the rest contract with or through GPO?

If the agency only uses the equipment for its stated purpose -- volume, turnaround, etc. -- such use is appropriate. However, the same problem befalls the agency that befalls all other in-plant facilities. If the utilization rate is not high enough, the cost of production increases to uneconomic levels. Agencies may use turnaround time as a justification. Here is an estimated agency plant "schedule":

Table 17

6 - 10 days	67%
2 - 5 days	17%
Same day	16%

Source: JCP "Report on a Study of the Federal Printing Program"; FJR estimates

Each agency's work is different and the forces that lead it to its own printing facility are many and varied.

We have noted that some agencies that had their printing plants closed applied high-speed copier/duplicators (such as the Xerox 9900) and probably produced more pages than they did with their printing presses.

Would or should the balance of agency versus GPO internal versus GPO contracted printing change?

It is doubtful that agencies with their own printing will surrender easily. There are justifications for their facilities, usually based on turnaround. For instance, the Centers for Disease Control releases a newsletter that is widely quoted by the press with significant health information. When its in-plant facility was closed down and it started to use commercial vendors, it was not always out on schedule. One must look carefully at the time value of the information and the recipient's need for it.

The members of the Federal Publishers Committee, which is made up of printing and publishing professionals in the Federal Government, complain continually about deliveries from the private sector. They blame GPO for not maintaining control over suppliers or penalizing offenders. Yet, even when contracting directly, agencies still find occasional delivery problems. Bad service can occur no matter who does the contracting.

4. GPO technology--electronic printing/publishing.

Is the alternative technically feasible?

The nature of the work printed at GPO falls into the two broad categories of database-related and non-database related. Let us enlarge upon this breakdown:

Table 18

	Internal	External	Total
Database-related			
Publication	4.4%	16.6%	21.0%
Document	12.6%	17.4%	30.0%
Other	3.5%	6.5%	10.0%
Subtotal	20.5%	40.5%	61%
Non-database related			
Promotional	4.5%	8.5%	13.0%
Utility	0.1%	11.5%	11.6%
Other	0.1%	14.3%	14.4%
Subtotal	4.7%	74.8%	39%
Total	25.2%	74.8%	100.0%

See Appendix 1 - 3, FJR estimates

GPO product codes were not designed for this analysis and our estimates are largely subjective and unsubstantiated. Electronic printing and publishing application requires an understanding of the differences between specific classes of page-oriented materials. A publication has more pages and prints more copies than a document. Both are primarily text related. The Record is a publication; most bills are documents, for example.

Table 19

	Publication	Document
Pages	More	Less
Schedule	High	Moderate
Bindery	Complex	Simple

Source: FJR

Most NTIS materials fall into our category of documents although some may be large enough to be publications.

The "Other" category has fewer pages than a document and may print more copies, such as newsletters.

Promotional material includes color pamphlets, brochures, catalogs and other materials that attempt to persuade. Utility materials are primarily forms. "Other" in this case includes tags, labels, folders and other printing miscellany.

Now we must distinguish between electronic printing and electronic distribution. The former involves the use of office copiers, copier/duplicators, or printer/copiers all of which, at present, are best suited for short-run, low page count documents and "other" -- 51% of GPO volume according to our chart above. Electronic printing is primarily sheet oriented rather than signature oriented -- a page rather than a group of pages.

Of the 51%, only the documents – 30% -- are suited to present state-of-the-art electronic printing. Given the fact that some of the materials we have categorized in this area can sometimes be very high in page count, possibly only 21% may be applicable for electronic printing.

Of course, even this small percentage would have an impact on cost. Where applicable, electronic printing can cut cost over conventional printing because of the reduction in labor and preparatory steps described earlier. The application is technically possible and probable so long as one understands the potential volume.

In terms of electronic distribution, using different approaches, we estimated that only about 30% of GPO materials were releasable via electronic distribution.

Thus, to summarize, only 21% of GPO material may be applicable for present electronic printing and only 30% may be applicable for electronic distribution, using this approach to the analysis.

These percentages do not include NTIS materials.

Can it be implemented with current commercially available technology?

The combined GPO/NTIS materials would allow a merged entity to cost justify current technology for the applicable workload and to develop a specification for equipment that would be suited to an increasing percentage of that workload. For instance, just as GPO spurred the development of digital typesetting in the 1960s through development of the CBS/Mergenthaler Linotype Linotron, it could take a leadership role in direct-to-plate technology or on-press electronic platemaking, or, more aptly, signature, duplexed electrostatic or ion deposition (copying) printing.

The integration of NTIS volume would accelerate the need for more efficient technology since it would be combined with GPO's applicable volume.

We envision a system that utilizes optical disk storage of NTIS and applicable GPO documents and smaller publications with on-line indexing and selection with printout via high-speed printer/copier. All of these "pieces" are available today. However, the automatic duplexing and binding functions may need some special

development. The combined volume would allow cost justification of the most advanced approach.

Is more research and development and/or pilot testing required or advisable?

There is a need for more intercourse between GPO and a wider range of outside consultants, industry developers, etc. Unfortunately, some trade associations represent a constituency that is not in favor of GPO expanding its role in printing or reproduction. But outside advice should be sought so as to prevent an isolated mentality.

There are already some agency projects (The Navy NPODS MilSpec system) for instance that could serve as test situations.

Does existing inplace equipment need to be upgraded?

No major upgrades are required. Equipment and process upgrading should continue in the same evolutionary manner that it has, adding functionality where labor, speed and quality can be affected to the benefit of the process.

How does existing equipment compare with the private sector?

As stated above, there is little difference between GPO and most larger commercial vendors in regards to technology for:

Electronic composition and page output
Camera and platemaking
Press
Bindery

Less than 100 U.S. printers are in the same league as GPO in equipment capability, and no printer that we know of has that equipment oriented to handle the work volume and turnaround that GPO has:

Out of 66,613 operating plants in the printing industries, 2,240 have 100 employees or more – 3.4%. The total includes 38,740 commercial printers, 938 book and publication printers, 4,722 newspaper plants, 936 forms plants, 14,372 in-plant printing sites anf 6,905 other plants. (Source: A.F. Lewis 1987 Blue Book Information Service.)

GPO ranks as the 39th or 40th largest printer in the United States using central office billings only.

Can private sector systems serve as a model?

The systems developed by commercial printers tend to be proprietary and related to specific classes of work. For instance: short run printers of hard cover books have developed specialized techniques that meet the needs of their market but are not useful for other classes of work.

Most innovation in printing industry firms affects specific classes of work, primarily longer runs, color, etc. Certainly, each instance can be instructive, but one must realize the unique technological challenge facing GPO in that it has definable production requirements that have few analogies in the commercial sector.

There are many points of comparison in regards to the printing process, such as those that we have made in parts of this report. But there is no single facility of service that matches GPO in product mix, schedule and, customer base.

5. Agency technology--electronic printing/publishing.

What level of technology should the agencies have to support their role in electronic publishing?

Any of four levels of document, publication or other database-related material page production:

Desktop -- PC approaches
Workstation -- 32-bit engineering workstations
Dedicated -- turnkey systems
Mainframe -- host-based publishing

All are applicable, depending upon the volume and type of material. With a degree of standardization based on typographic tagging (text and table indentifiers), keying technique, code format and information structure, agencies could have access to decentralized high quality printout, conversion to and from other agencies while maintaining the control they desire over their publication production.

Is the current equipment adequate or should most major agencies invest in high-end electronic publishing equipment?

Most do not have the volume to cost-justify high end equipment. 85% of all agencies should apply PC Desktop or Workstation level capability.

High-end electronic publishing systems are presently priced at $100,000 for a single-station configuration, However, the price per station goes down as additional stations are added because the cost of the CPU and software can then be distributed across the stations. A typical 4-station high-end system would be priced at about $240,000 or about $60,000 per station.

Workstation approaches are closer to $40,000 per station and Desktop approaches are near $12,000 per station. Each level is definable in terms of page volume and complexity:

Table 20

	Page Volume	Complexity	Datbase links
Desktop	Low	Low	Few
Workstation	Moderate	Moderate/High	Some
Dedicated	High	High	Many

Source: FJR

A potential user must have the volume level and then must have costs that exceed the price of the equipment and any dedicated labor. Cost justification is based on meeting the production need and then evaluating whether the alternative approaches are cost justifiable.

Will this equipment interface properly with GPO?

It must be stated that all files can be converted to a standard code format with certain tags imbedded in the copy. Almost all newer equipment will do this. However, the identifiers at GPO are inhuman and illogical and most agencies resent inserting them. This may seem harsh, but it must be realized that GPO is one of the few organizations in the world that advocate this approach. If it had user acceptance or validity, would not others advocate it as well?

GPO must develop a more mnemonic, user oriented, friendly set. Resistance to this approach continues in light of progress in generic tagging. The "logically structured" codes are logical to the computer, not to the operator. We think that machines should adapt to people, not the other way around.

What is the difference between the GPO approach of using BellI103 for a first level head and {H1} for the same thing. At least, with the latter approach there is a chance of better remembering it. This approach is called mnemonic coding since it relates to alphabetic reference points. The GPO approach can be meaningful when viewed in the context of a closed system or society -- that is, everyone must use the same approach.

However, the advent of desktop and other approaches is making users more aware of alternatives. There are some approaches that are even worse than GPO -- some desktop systems require key sequences like "Control Option Shift Close Paren" to accomplish some tasks. GPO should be taking a leadership position in examining all approaches objectively.

The Dial Up Composition approach is excellent, but fewer than 10%, in our opinion, of all agencies will use it over time. It is code oriented and competing desktop and workstation alternatives are not. The have different approaches that are perceived to be more user friendly. The move to put the GPO program into a

PC is also excellent, but the element identifiers will produce resistance. Also, as desktop publishing moves foward, increasing in sophistication, agencies will want to do more of their own pagination.

Right now PostScript is a defacto standard, supported to some extent by both IBM and Xerox, two organizations that traditionally have evolved their own "standards". GPO must also take a leadership role in accepting PostScript data from agency users. In less than two years, over 400 commercial firms have established PostScript printout services (TypeWorld directory, 1987).

Will standards be a problem?

Not if a reasonable standard that existing technology can handle is developed. For text, ASCII files with generic identifiers have become a defacto standard. There are challenges as well as opportunities here:

Challenges:

1. Select specific approaches to be supported.
2. Evolve necessary modifications.
3. Train and educate user communities.
4. Provide electronic pathways from non-standard systems.

Opportunities:

1. Commonality of data structures.
2. Efficacy of data interchange.
3. Reduction in technical training and support.
4. Increased distribution channels.
5. More and better links to commercial services.

How should desktop publishing systems interconnect with agency and/or GPO high-end systems, if at all?

There should be compatability. As long as text and tables are converted into ASCIII files with tags, then almost any system available today should be able to accept them and convert them to that system's internal code level. Programs available for DOS-based PCs can provide batch and interactive pagination and convert back into word processing files while retaining the element identifier tags.

A government-wide recommendation for two or three software packages and hardware configurations would go a long way toward creating a base of standardized use.

Such recommendations might involve:

1. Programs that have built-in filters for data conversion, both input and output oriented.
2. PCs with floppy disks that are of one or two density versions.
3. Word processing programs that meet certain office requirements as well as good publishing capabilities.

4. Programs and approaches that can take statistical data for interface and exchange.
5. Telecommunications procedures that are menu based.
6. Recommended element identifier tags.
7. Standardized lists of special symbols with standardized nomenclature.

6. GPO operational functions.

What will be the impact on current GPO operations, such as conventional page makeup, composition, platemaking, binding, printing, and on possible future GPO operations such as electronic printing, printing-on-demand, CD/ROM dissemination, and the like?

In order to apply any of these technologies there must be an electronic file of typographic pages. Thus, GPO composition technology will not be affected substantially except in its inability at present to handle graphics efficiently. The operation has essentially found the work that is most applicable -- database related work -- which is primarily text. As shown, the window of opportunity for government data that is applicable for these approaches is low.

We would not expect a substantial increase or decrease in the composition area. If it could output more of the pages printed internally as 70mm microfilm, then there could be benefits that accrue to the platemaking area.

Most of the printing that is done in-plant is composed in-plant. Thus, GPO essentially controls its own destiny in this area. It can implement a number of approaches to save time and labor and therefore cost -- such as direct to plate technology or direct to imposed film negative.

GPO will still use conventional printing and electronic approaches will have minor impact.

What will be the impact on other GPO operations such as marketing, contracting, cataloging, customer services?

These would only be impacted if there was a significant change in the way GPO disseminates information and we do not see that volume at present as being substantial enough to do this. However, merger with NTIS would have many impacts since newer technology could be applied.

Consolidation and centralization usually results in:

1. No duplication of effort.
2. Consolidation of skilled personnel.
3. Ability to justify backup equipment.
4. Optimization of space and facilities.
5. Larger, more automated technology.

7. Agency operational functions re. printing/publishing.

What will be the impact on agency operations, as above?

Since most agency work is short run, low page count volume it is more applicable to copier-based approaches -- however, because of the bindery requirements, signature printing is still more cost effective. Most agencies that closed their offset duplicator press operations replaced them with copiers such as the Xerox 9900 which required less manning. They increased output substantially.

GPO/NTIS should become the largest quick printer in the world, with technology for demand access and reproduction. A quick printer (and there are 14,000 in the U.S.) is essentially a retail-oriented, while-you-wait service. It accomplishes this by standardizing on paper of standard size, with only a few varieties and black ink. These firms were among the first to utilize copier/duplicator devices.

Some of the data (NTIS) could come from rasterized databases (scanned pages), some from code databases (Legislative, Executive), some from copying, with some printing of existing hard copy pages. When the GPO document volume is added to the NTIS document volume, the result would necessitate technology that would be analagous to quick printing services.

8. GPO labor force requirements.

What will be the impact on the number and types of employees needed by GPO?

We see phased reduction in workforce due to attrition as increasingly higher levels of automation are implemented in most process areas.

As agencies continue to implement personal computers and desktop publishing, they will have low level electronic printing systems (desktop approaches use laser printers). Thus some volume -- and we expect that it would be very small, perhaps 10% or less -- might move back to the agency where very low page count documents could be printed out on demand. We have no base of data to support this opinion.

With other evolutionary improvements in printing technology we expect that the skill requirements for conventional printing will remain, although there would be gradual reductions in the volume of labor.

Newer technologies, although not labor intensive, will call for more highly skilled personnel trained in electronics, computers and software.

How are these needs likely to be affected by projected attrition rates from retirements and separations?

If attrition got ahead of implementation, part time and contract personnel could be used. If implementation got ahead of attrition, the implementation could be slowed.

What new hiring and/or forced layoff requirements are likely?

No forced layoffs should be required since attrition will probably keep up with automation, and new hiring would probably be in the areas of new technology skills.

9. Agency labor force requirements re. printing/publishing.

What will be the labor implications, as above?

Most of the electronic printing technology that would be applicable at the agency level should not require the highly skilled personnel that a centralized approach would require; however, there will be the need for specialized training but not to the level required for conventional printing.

10. GPO plant and equipment.

Is the current GPO plant adequate today, for the next few years, for the next decade?

With the change to offset printing as a replacement for letterpress equipment, GPO printing technology will be more than adequate for the next 5 to 10 years. After this timeframe, we expect technological changes in the ink-on-paper process -- electronic signature printing, on-press platemaking, instant makeready, dry printing, silverless films, and others.

The longer term technological changes would continue to reduce labor, increase speed and quality and cut cost. They will require new skills and high capital investments, at least during their introductory period.

Is there any need for significant renovation or for a new plant?

The present building was specifically built to the load factors of the printing process. Although elevator movement of materials is somewhat inefficient and should be improved, this is more than offset by its proximity to its customer base. A single level building would have to occupy many acres and would have to be some distance away from the present GPO location and would present different production problems.

Other than slow elevators, we see no overwhelming advantage to moving GPO to a different facility.

How do GPO plant facilities compare with the private sector state-of-the-art?

About 56% of all commercial printers are in buildings over 30 years old and very few were ever designed to be printing facilities. The GPO facility is equal to most commercial facilities that handle its volume.

Most newer printing plants are on one floor and workflow is organized for maximum efficiency. The GPO facility is multi-storied.

What are the implications for remote, decentralized printing operations?

There are two aspects to decentralized operations:

1. Small printing and copying plants at agency locations. 233 printing and 800 copying operations are in existence according to JCP/GPO. Both require "artwork" or camera-ready pages for reproduction.
2. Remote reproduction sites that accept coded data to print electronically on a printer/copier or produce art, negative or plate for conventional printing.

This latter approach is most applicable with very long run materials that must be distributed to a very large audience. IRS materials are a good example. Unfortunately, such materials require larger presses that would sit idle at regional facilities. An industry-government partnership is a good alternative, where printers that met specific criteria for equipment, mailing, etc. would receive negatives for local printing and distribution.

Electronic printing approaches do not seem applicable for GPO products because of run length, page count, etc. However, if NTIS were merged with GPO, purchasers of NTIS reports could order them at GPO bookstores or other locations and they could be printed out there as well. The location could have a set of optical disks with all reports available for printout or a dial-up line to receive reports that must be transmitted.

Taken together with technology requirements noted above, what are the capital investment requirements for GPO plant and equipment over the next 10 years?

Private sector printers invest between 2.8% and 8.8% (average 5.8%) according to National Association of Printers and Lithographers' studies, of their total budget every year according to ratio studies. They also receive depreciation tax credits. Using $176 million as an equated income to a commercial firm, with less than 1% of the commercial printers applicable, GPO should invest over $10 million per year. The two new web presses total $10 million. However, we feel that capital investments may only average less than $4 million per year on average over the next decade and that all investments would be cost justifiable on the basis of cost reduction and improved productivity.

11. GPO finances.

What is the estimated impact on the major cost components of GPO operations--labor, materials, plant and equipment, etc.?

Traditionally the printing process breaks down as follows:

Table 21

	Commercial	GPO
Labor	26%	44%
Materials	34%	30%

The GPO numbers are our very rough estimates. The data would only apply to printing. One must break out procured printing, deduct the employees that are involved in procurement and re-allocate certain expenses. Composition, for example, is more labor intensive with less materials.

Increased automation and electronic technology would reduce materials and labor.

12. GPO pricing.

What is the estimated impact on pricing of GPO products, assuming specified demand, overhead, etc.?

Demand is a factor of the product and the market; price is a reaction in many cases. Cost is a fact; price is a philosophy. For most GPO products, we do not predict any adverse impact on pricing.

How do these prices compare with agency and private sector comparable offerings?

After a product is printed, it is easy for someone to pick it up and state that they might be able to produce it at less cost. One must examine all inputs, schedule, changes and alterations, competitive workflow within the organization as well as standard overhead factors.

Since no commercial service is a complete equal of GPO, it is difficult to have all the points of comparison that would provide a fair comparison. Taking selected products for comparison also can be misleading in that there may have been impacts that GPO is subject to that commercial services would not be subject to.

However, our best estimate is that GPO pricing is, overall, within plus or minus 11% of the commercial sector.

13. Printing management and bibliographic/format control.

What are the implications for the efficient management of the government's printing operations (e.g., optimal matching of printing options with job specifications) and for indexing and formatting of government publications and Federal information in general?

Traditionally one entity has been responsible for printing and procurement. If either function moves to a different entity, the other must move as well. Management requires information and to manage publishing -- conventional or electronic -- requires the data that comes from control of the processes.

Certainly the physical facilities and the people who go with them might move, but the access to the workload for selection of appropriate products to fill in the gaps of priority product production must be provided.

14. GPO and agency productivity.

What aspects of agency productivity are likely to be affected--research, writing, analyses, data processing, report drafting, editing, layout and composition, graphics, review cycles, marketing, printing, other dissemination?

New publishing technology will have a substantial beneficial effect on agency productivity, if applied properly. There needs to be centralized professional assistance in systems selection, installation, training and implementation. Presently, each agency goes its own way, and based on the low-bidder purchasing process, the Federal Government winds up with a plethora of dissimiliar equipment.

GSA contracts for this technology should be developed as they were for typesetting and other technologies. Some degree of standardization in the form of "boiler plate" specifications should be provided to each agency so that equipment meets certain minimum requirements, such as:

1. The ability to accept certain magnetic media formats and coding.
2. The ability to handle modifiable table translations (also called filters).
3. The ability to re-process a page file into a word processing file.
4. The ability to handle certain telecommunications protocols.
5. The ability to handle line art graphics in a standardized manner via scanner and/or on-screen drawing.
6. The ability to tag files with typographic element identifiers.
7. The ability to accept encapsulated PostScript and to output PostScript files in addition to any other drivers.
8. The ability to link into GPO centralized or decentralized printout facilities -- such coding to be provided.
9. The ability to store and retrieve files in a standardized manner (such as UNIX) so as to reduce training and support and allow inter-agency file transfers.

In those cases where we have had personal involvement, the agency was able to implement new publishing technology with no increase in personnel and to

eliminate outside page production charges. A major requirement for such cost justification involves the use of word processing and other electronic origination approaches to "capture" data for publishing, thus eliminating re-keying and to allow interface to a publishing system for pagination, proofing and revision cycles prior to page finalization.

To apply publishing technology properly involves the development of internal procedures and approaches that improve individual productivity while contributing to overall productivity. By allowing individuals and work groups to see the typographic result of their efforts (proofs, simulated screen representations) early in the process, revisions are handled more routinely and production cycles are improved.

Electronic publishing can be a byproduct of many of the trends now evident in Federal offices:

1. Word processing.
2. Dot matrix or laser printing.
3. Links to ADP.
4. Databases.
5. Telecommunications.
6. Statistical analyses.

What are the likely impacts on working relationships between GPO and the agencies?

If GPO takes a firm, inflexible stance in regard to agency uses of electronic publishing, the result will be continuing animosity and more creative methods for getting around JCP rules and regulations.

GPO, or anyone else, must realize that decentralization of page preparation is a reality. It must gear up to support these users in both acquisition, implementation and on-going support.

There must be closer working relationships with agency publishing users and support for a number of industry available programs, devices and systems.

What are best estimates of impacts on specific productivity measures, such as units of work,

The varied nature of GPO printing makes it difficult to develop a benchmark for production monitoring, such as pages. "Page equivalents" is another approach but it cannot help with tags, labels, etc. For each work type there will be different benchmarks. With automation, we expect that increases in unit production can be improved, whether conventional or electronic technology is applied.

quality of work,

The use of agency publishing technology will help to move the government away from typewriter-like printout to typographic printout. No other changes in quality are predicted.

timeliness of work, as they relate to information functions?

Automation impacts turnaround and scheduling. Faster presses, faster platemaking, faster page production -- are some of the areas that accrue to affect the overall process.

What are other relevant productivity measures, such as use of postage and paper, transportation requirements, and potential for recycling of paper (and other waste products), and how might they be affected?

If GPO became an electronic Legislative facility, savings in paper, labor, etc. would total a maximum of $80 million if all work could be handled electronically. Since this is probably not possible, in that paper formats will still be required, the volume involved may be closer to $20 million, with bottom-line savings at less than $10 million. These estimates are based on broad hypothetical situations, most of which assume that Legislative materials will still require a major composition, pre-press and printing operation.

Conventional printing continues to undergo continuing, almost relentless, automation. The printing process manhour is 4 to 6 times more productive today than it was a decade ago (FJR estimate). The use of new consumables such as alternative inks (such as newspaper experimentation with soy-based products), re-cycled or non-pulp-based papers, or films and plates that require less or no silver for imaging will lower costs. Paper recycling continues at GPO and there are savings of thousand of dollars each year by reclaiming silver from film and chemistry.

Process automation is available and is accelerating at every level. GPO has applied most of the technologies that have been available to the private sector and have paid for devices and systems (such as the adhesive binding line or the passport press) that are somewhat unique and almost one-of-a-kind.

Are there any baselines or models that can be drawn from the private sector or agencies that have conducted evaluations?

Few are applicable, since work type, volume, origination, finances and markets are all variable. There are partial analogies that could offer some input:

1. Newspapers have the kind of volume and schedule that typify the Record and Register, but the GPO work is straight text, where newspapers have advertising and graphics.

2. Financial printing firms have to typeset, revise, finalize and print prospectuses and other documents overnight. The schedule is similar but the volume is in most cases lower.

3. Book publishers have the volume of text, but not the schedule.
4. Advertising typographers have the volume and schedule but the work type is very different.
5. Looseleaf publishers have the text volume but not the schedules.
6. Most corporate publishing in organizations stops at about 5pm. Volumes may be high but schedules are not as tight.
7. TechDoc or proposal work has spurts of volume and schedule that are close but not as sustained.

How do productivity impacts translate into GPO and agency budgets, savings, appropriations, etc.?

Agency budgets are not affected to a large extent since most of their work is procured, not printed in-plant. The dynamics of the competitive private sector should keep costs relatively constant. GPO filler work would continue to enjoy the cost benefits of automation and new consumables.

16. Private sector relationships.

How will GPO relationships with the private sector printing and information industries likely be affected?

If data was released by GPO as tapes, optical disks, floppy disks, etc. as routinely as it releases paper formats, there would be competition with data resellers who might limit the formats that they offer. However, our estimates indicate that the volume of data that can be released in electronic form may not be high enough to have any substantial impact. An electronic GPO would not impact the private sector because the material that would be most affected is the work that is printed inhouse and is not available for commercial printing in most cases.

If electronic publishing technology was standardized to some degree more data could be provided to the private sector in electronic form. This would cut production cost in most cases as well as provide more material to data re-sellers.

It is interesting to note that the major supporter of GPO procurement from private sector printers, the major association of such printers, advocates not subcontracting any work that can be done internally if at all practical. We think that this same philosophy, based on good business policy, should be practiced by GPO -- print or produce internally only those materials that meet specific criteria for schedule, applicability or cost.

Will there be any significant beneficial or adverse impacts on the competitive status or economic health of the printing and information industries?

No adverse impacts are predicted; increased volume to commercial services would certainly be a benefit. Information industries would benefit as more of the database-related work was made available in electronic form.

What are the implications for cooperative, contractual, and/or competitive relationships between GPO and the printing and information industries?

We would like to see more longer term contracts for repetitive work types rather than continuing re-bidding that results in different contract printers from year to year on repeating products.

Quality, turnaround and other aspects vary accordingly. GPO or any other entity must enforce contract provisions. Agencies complain of poor quality and delivery and, even though in the minority, still should not be acceptable; the offending service should be penalized.

Competitive situations should be reduced. Quick printers have found that their best customers are the ones with the most copying machines. That is, the users of automated technology have the kinds of volumes that require outside services to augment production. Thus, the size of the GPO central plant should not be viewed as a competitive situation by commercial vendors but as an indication of overall volume, some of which lends itself to inplant production and much of which would be procured.

17. Equity of access.

What are the implications for access of the general public, public interests groups, and the academic/research/scientific community to Federal information?

Even with electronic dissemination, hard copy will still be a required option. In fact, we prefer to look at it the other way around. Electronic dissemination will be a by-product of conventional printing and it is doubtful that print on paper will be replaced for the majority of information consumers by the year 2000. Thus, no consumer will be locked out of the information loop. By combining GPO and NTIS sales, increased marketing, local stores (some with remote printout) and general availability of information in a variety of forms more people will have more access to more information.

The combination of GPO/NTIS should result in a greater number of outlets for Federal information.

Are changes in format, availability, pricing and channels of distribution likely to facilitate or impede or have no significant impact on access?

Pricing is usually based on the value of the item to the market. Government pricing is based on cost. New forms of information should reduce cost and improve access for some audiences.

18. Legislative/oversight changes.

What are the implications for legislative action (e.g., amendments to public law, changes in oversight committee organization, appropriations) necessary to implement the alternatives?

There would have to be a restructuring of the law to move GPO printing and procurement of Executive branch materials to the Executive branch. The law that established the GPO was written at a time when most of the work was Legislative and very little was Executive. That situation has changed.

For 125 years the Legislative branch has controlled printing for the Federal Government even as its share of the information volume has continued to drop.

APPENDIX 1

The breakdown between potential database and non-database materials is a crucial one as the Federal Government plans for the future. One cannot release a tag in electronic form, for example. IRS forms books for the most part must be printed. These are only two examples. Everyone we interviewed at GPO admitted that a large amount of material that was printed or procured by GPO was not suitable to database or electronic approaches. Thus, it became important as we progressed with this report to have some quantification of the volume involved.

Here are four approaches that one might use, with our assumptions, as well as the limitations of the approach. Arguments and challenges abound, but there is a need to have some data that is "in the ballpark."

The only way to have the exact figure is by reviewing every job that GPO does over a period of at least six months and ascertaining the nature of the product, the copy it contains and whether or not it can be database related and if so, whether the information can be released, electronically or not. The same is true for agency plants. Until then, our estimates are based on the thinking and facts that follow.

Approaches to quantifying database vs. non-database materials:

1. Dollars

One could use the "Report of Billings by Product Code and By Branch" and quantify the non-database items (they are relatively easy to identify -- "ink/glue, layout sheets, freight, etc."). Out of $770.6 million in total billings, non-database items total $322.4 million or 42.4%. This figure only applies to goods and services printed or procured by GPO. In some cases, the determinations of the product as database or not was a judgement call. However, most product categories are quite clear.

Table 22

	Non-database	Potential Database
Commercial Procurement	34.6%	40.1%
Central Office	7.2%	16.2%
Regional Printing	.6%	1.3%
	42.4%	57.6%

Again, using dollars, the following percentages apply when the Federal Register is re-allocated:

Table 23

	Fed. Reg. in Leg.	Re-allocate Fed. Register
Legislative	14.6%	12.3%
Judicial	.3%	.3%
Executive	85.1%	87.4%

To apply this approach to materials produced in agency printing plants one would have to know the breakout of non-database versus potential database dollars. Our assumption is that most agencies produce mostly text pages and that text pages are potentially database related.

A 1982 Report "President's Private Sector Survey on Cost Control, Volume I, Publishing, Printing, Reproduction" used unpublished GPO data and a GAO study to state that "non publication printing is estimated to account for 50% or $95 million of the total cost of running agency print shops." "Non publication" is assumed to mean non-page-oriented, and thus not potentially database related.

If this data is correct, it would change the above percentages to:

Non-database	Potential Database
43.4%	56.6%

for all Federal Government. The numbers do not produce a significant difference and thus GPO statistics should then be valid for the government as a whole. We have not used this agency quantification in our estimates.

2. Pages

This method is less exact because there is very little hard data. The GPO Cumulative Analysis of Congressional Jacket Billings indicates that 1,076,154 pages were produced (typeset) for FY 87: 1,022,541 without the Federal Register.

Using the data on the ten largest customer billings, we developed a factor to convert dollars to pages -- if Congress had $68.0 million in billings representing 1 million text pages, we could apply a similar relationship to the other customers. This resulted in a total of 764 million pages. Since the 10 customers represented 71% of the total GPO billings, the balance of 125 customers totalled 312 million pages for a grand total of 1.08 billion pages.

2.4 million pages are presently being typeset (30.4% by GPO input and 69.6% by tapes or other input) and they are all database related. One must watch for re-run, correction or patch "pages" to eliminate duplication.

Once again, some percentage of these "pages" are clearly not database oriented. Our "pages" are called "equivalent pages" since they attempt to reduce all materials to a quantifiable base. The problem that arises involves allocation of items such as tags and labels into equivalent pages. Since there is no data maintained in this form, most of the opinions become "guesstimates".

Since Legislative materials represent 12.3% of all GPO work (after re-allocation of the Federal Register), and most (let's say 80%) of Legislative work is database related, we have at least one known quantity. It is the breakdown of Executive Branch materials -- 87.4% of total volume -- that is unknown. That led us to method #4 which involves an analysis of a sample population of Executive "customers" who print or procure materials through GPO.

Thus, this method does not yield significant conclusions, although some of the data might be used for cross reference.

We would have liked to complete the following formulae as a basis for determining applicable volumes for electronic approaches:

1.				
Number of Publications (N)	x	Reproduced Copies (R)	=	Total Publications (T1) 1.4 billion
2.				
Pages Per Publication (P)	x	Number of Publications (N)	=	Total Pages (T2)
3.				
Total Pages (T2)	-	Not Releasable (X)	=	Actual Pages (A)

3. Paper

A GPO Fact Sheet indicates that the 100 million pounds of paper used by GPO would "circle the earth 15 times if each sheet were laid end to end." The arithmetic yields 2.1 billion sheets.

However, our calculation, based on 105 million pounds of paper of 20 lb. sheet weight (2,000 sheets to 20 pounds) yields 10.5 billion sheets and 40 lb. sheet weight yields 5.3 billion sheets.

A sheet of paper has two sides, of course, and equates to two equivalent pages. The nature of the printing process is such that bound publications and documents have some blank pages. This results from the need to print 4, 8, 16 or 32 or more pages per signature unit. Thus, a 16-page publication may have only 15 printed pages, as an example. Thus, getting from paper use to printed pages is inexact because of the peculiarity of the way most publications are printed.

If there were 1.4 billion publications produced, as the 1986 annual report states, then the number of pages must be well over 14 billion (using 10 pages per publication as a very low average).

4. Sample Population

Since 1972, we have served as consultants to over 650 U.S. and Canadian organizations (including the Canadian government) and have been involved -- in regards to typesetting and electronic publishing of published pages -- with more Federal Government users than most other consultants. A primary part of our analysis is a complete review of all pages by volume, size, content and typography. For instance, at the Bureau of the Census, we had access to every document and publication and reviewed virtually every page to determine a count of 505,000 pages and percentages of computer-generated, boilerplate and other origination by table or text data. Using the following as a sample group, and applying our estimates (not those of the agency):

Table 24

	Non-database	Potential Database
National Center for Health Statistics	17.1%	82.9%
Bureau of the Census	9.9%	90.1%
Centers for Disease Control	60.2%	39.8%
Department of Energy -- OSTI	17.2%	82.8%
Defense Mapping Agency	76.7%	23.3%
Average	36.2%	63.8%

Whether or not this is a meaningful sample population is unknown. The five groups represent almost 900,000 pages of material that were printed or procured through GPO to which we had detailed access.

If we then take the results of dollar analysis and sample population, we arrive at:

Non-database	Potential Database
39.3%	60.9%

We feel that these percentages are useful working statistics for GPO. We have rounded the results to 39% vs. 61% since they are referenced several times. These percentages apply specifically to materials printed or procured by GPO -- however, they may possibly be used as a sample population for all Federal Government as well, since GPO work is essentially the majority of government work.

The next question is "what percentage of the database related material is actually releasable in electronic form?" Military materials for the most part are not. IRS materials for the most part are not. "Releasable" means that the several criteria are met:

1. That the audience for the data has the technology or has access to the technology to utilize the data. The recipients of an IRS book of forms represent the U.S. population. Even the most optimistic projection would show that only a small percent will have personal computers or other technology as well as the ability to handle IRS material electronically.
2. That the data is not secret or confidential or restricted for reasons of national security.
3. That the data lends itself to electronic methodologies because it is primarily text oriented. Materials that are forms, promotional, or have heavy graphics, such as maps, may have a lot of text but would not normally be released electronically.

Additional assumptions:

Using the "Largest Customer Billings" table comparing 1986 and 1985 billings for 10 largest customers:

Knowns:

1. These "customers" represent 71.6% of all GPO printing and procurement.
2. Congressional work represents 12.2%.
3. The three military branches total 46.1%

Assumptions:

1. 90% of all Congressional work is database related and releasable in electronic form (this is a higher number than we report elsewhere).
2. The military materials may be database related but are not releasable in electronic form -- the technological base does not exist to release the majority of training, maintenance and operational materials electronically.
3. That perhaps 10% of all materials are database related and releasable as such.

Therefore:

Of this sample ($557.8 million for ten "customers") representing 71.6% of GPO total:

1. 11.0% (12.2% x .90) is absolutely database related.
2. 41.5% (46.1% x .90) is not database related.
3. Applied against total GPO billings
   a. 7.9% (11.0% x .716) is database related.
   b. 30.0% (41.5% x .716) is not database related.
   c. The 30.0% is all Executive material.

We arrive at some conclusions:

Table 25

	Of all GPO	Known Releasable	Known Not Releasable
Legislative	12.3%	7.9%	--
Judicial	.3%	--	--
Executive	87.4%	--	30.0%
	100.0%	7.9%	30.0%

Then, of the 61% potential database material, 30% is not releasable and 31% is releasable, of which at least 7.9% is now readily available.

Table 26

	Non-database	Potential Database	
Of all GPO	39.3%	60.9%	100.0%
Not releasable	39.3%	30.0%	69.3%
Releasable	0	30.9%	30.9%

APPENDIX 2

Database

The term "database" refers to information in electronic form, usually in ASCII or some other coding system. Traditionally, databases were stored in mainframe computer systems and items were "compartmentalized" into records and fields. Thus all "names" might be a record with fields for address, phone numbers, etc. Since the "address" was always stored in a special area only for addresses, the data could be manipulated, sorted or re-configured. One could sort on any field or fields.

Today, most informational databases are text oriented. There is little record/field itemization except for statistical data; however, text elements may be tagged to define typographic changes such as indents, headings, footnotes, etc.

Our term "non-database" refers to printed or copied items or information that do not lend themselves to electronic storage, access or printout. A mailing label, file folder, package tag, passport, postal card or memo pad are examples. A computer file of salary information is technically a database, but is not usually released to the public. Our term "potential database" refers to printed or copied items or information that can be stored, accessed and printed out and contain material that can or should be communicated to the public.

Information stored in mainframe, mini- and micro-computers is capable of access and printout. It can also be converted from one code to another code in order to move it from system to system. Thus, a newsletter stored in a PC is just as much a database as a 100-page publication stored in a large computer system.

Information stored electronically, or database, can be accessed via an on-line or remote terminal (soft copy) or printed out on a local or remote printer (hard copy) or output as microform, or output as hard copy from a higher-resolution printer and then printed on a printing press because of number of pages or number of copies.

In most cases, electronic access results in printout of specific pages. The computer aids in searches and allows data to be pinpointed. Most publications may contain only a few pages that the reader needs to reference. Thus, only those few pages are output, not the entire publication.

APPENDIX 3

Demand Pritning & Publishing refers to the production of printed or copied materials on an "as required" basis by an audience. Traditionally, a quantity of publications would be produced and stored to await orders for copies. In some cases, the quantity would be depleted and the material would have to be produced again. In either case, if the order input was unknown, and in most situations, it would not be, publications would remain unsold or undistributed. They would then be discarded after some deadline.

In 1986, Frank Romano served as principal researcher for the Institute for Graphic Communication multi-client study on Demand Printing & Publishing, the most comprehensive study published on this subject. The results of this study have been available for the OTA report.

Major findings include:

1. Traditional printing will be reduced, not eliminated. The first run of most publications, a short run in many cases, would still be done by signature-based printing and binding. After depletion of inventories, future printout would be "as required."

2. Electronic printing is not a replacement for traditional printing. For runs over 2,000 copies of 100 pages per publication, signature printing and binding is most economic. For runs of 1,000 copies or less of 100 pages or less per publication, electronic printing (Xerox 9700 type) is most economic. Between 1,000 and 2,000 copies, both processes have economic disadvantages.

3. Major technological shortcomings of electronic publishing include: automatic duplexing and sorting from electronic data, limitations on paper types, on-line binding approaches, and consumable (toner) costs.

4. Major operational benefits include: less labor, elimination of press makeready, elimination of pre-press processes and on-line sorting.

Technically, any electronic printer/copier is a demand device, although speeds of 100 or more pages per minute are required for high volume situations. Slower devices can be distributed to user locations and virtually any printer can be a remote output unit.

APPENDIX 4

Throughout this report there has been a distinction between publications and documents (as well as other categories). The reason for this differentiation is that documents are usually short-run with lower page counts, whereas publications are longer-run with higher page counts.

Documents lend themselves to demand printing and publishing; publications do not. This characterization of printed products is part of a matrix developed by the author to better define such products. It is not a characterization used by GPO.